BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

As rescanning documents *will not* correct images, please do not report the images to the Image Problem Mailbox.

AMENDMENTS TO THE SPECIFICATION:

Please amend the paragraph beginning at page 1, line 13, as follows:

A liquid crystal display device may be grouped into two types, [[in]] one of which the molecular axes of aligned liquid crystal molecules are rotated in a plane perpendicular to a substrate to display a certain image, and [[in]] the other of which the molecular axes of aligned liquid crystal molecules are rotated in a plane parallel with a substrate to display a certain image.

Please amend the paragraph beginning at page 5, line 9, as follows:

However, the conventional liquid crystal display devices suggested in the above-mentioned Publications are accompanied with problems of incomplete ~~shield~~ shielding and reduction in an efficiency with which a light is used which reduction is caused by a common electrode composed of light-impermeable material.

Please amend the paragraph bridging page 5, line 26-page 6, line 8, as follows:

In order to accomplish the above-mentioned first object, a data line is designed to be overlapped by a transparent common electrode for shielding an electric ~~filed~~ field leaking out of the data line in the IPS mode liquid crystal display device in accordance with the present invention. However, this structure is accompanied with a problem that since a transparent material has a high resistance, there would be generated a voltage difference which would prevent electrodes from being properly driven for displaying images, as pointed out in the above-mentioned Japanese Unexamined Patent Publication No. 9-236820. Accordingly, the second object of the present invention is to provide an IPS mode liquid crystal display device in which a common electrode comprised of a transparent electrode overlaps a data line, and the common electrode could have a reduced resistance.

HAYES SOLOWAY P.C.
130 W. CUSHING ST.
TUCSON, AZ 85701
TEL. 520.882.7623
FAX. 520.882.7643

175 CANAL STREET
MANCHESTER, NH 03101
TEL. 603.668.1400
FAX. 603.668.8567

Please amend the paragraph bridging page 7, line 24- page 8, line 23, as follows:

In one aspect of the present invention, there is provided an in-plane switching mode active matrix type liquid crystal display device including (a) a first substrate, (b) a second substrate located opposing the first substrate, and (c) a liquid crystal layer sandwiched between the first and second substrates, wherein the first substrate includes (a1) a thin film transistor having a gate electrode, a drain electrode and a source electrode, (a2) a pixel electrode each associated to a pixel to be driven, (a3) a common electrode to which a reference voltage is applied, (a4) data lines, (a5) a scanning line, and (a6) common electrode lines~~, the~~. The gate electrode is electrically connected to the scanning line, the drain electrode is electrically connected to the data lines, the source electrode is electrically connected to the pixel electrode, and the common electrode is electrically connected to the common electrode lines~~, molecular~~. Molecular axes of liquid crystal in the liquid crystal layer are rotated in a plane parallel with the first substrate by an electric field substantially parallel with a plane of the first substrate and to be applied between the pixel electrode and the common electrode, to thereby display certain images~~, the~~. The common electrode is composed of transparent material, and are formed on a layer located closer to the liquid crystal layer than the data lines~~, the~~. The common electrode entirely overlaps the data lines with an insulating layer being sandwiched therebetween except an area where the data lines are located in the vicinity of the scanning line~~, the~~. The in-plane switching mode active matrix type liquid crystal display device further includes a light-impermeable layer in an area where the common electrode entirely overlaps the data lines~~, the~~. The light-impermeable layer is formed on the second substrate or on the first substrate such that the light-impermeable layer and the liquid crystal layer are located at the same side with respect to the

HAYES SOLOWAY P.C.
130 W. CUSHING ST.
TUCSON, AZ 85701
TEL. 520.882.7623
FAX. 520.882.7643

175 CANAL STREET
MANCHESTER, NH 03101
TEL. 603.668.1400
FAX. 603.668.8567

data lines and that the light-impermeable layer faces the data lines~~, the~~. The light-impermeable layer is comprised of a black matrix layer or multi-layered color layers~~, the~~. The black matrix layer or the multi-layered color layers has a width smaller than a width of the common electrode overlapping the data lines.

Please amend the paragraph beginning at page 12, line 3, as follows:

For instance, if the black matrix layer 17 had a width of 6 μm or greater as long as the data line 24 overlaps the black matrix layer 17, it would be possible for the black matrix layer 17 to sufficiently interrupt light[[s]].

Please amend the paragraph beginning at page 13, line 10, as follows:

It is preferable that the in-plane switching mode active matrix type liquid crystal display device further includes an interlayer insulating film formed below the common electrode overlapping the data lines. The interlayer insulating film is comprised of an upper layer and a lower layer[[ed]], and the upper layer is formed only below a portion of the common electrode which portion overlaps the data lines.

Please amend the paragraph beginning at page 16, line 10, as follows:

It would be possible to electrically connect the common auxiliary electrodes located at opposite sides of a pixel, to each other without much reduction in [[an]] the efficiency at which [[a]] light is used, by locating the common auxiliary electrode composed of opaque material, just below the pixel electrode having a slightly smaller transmissivity than that of the common auxiliary electrode. However, if the pixel auxiliary electrode were arranged below the common electrode, an electric field would be generated between the common electrode and the pixel auxiliary electrode, resulting in that a desired horizontal electric field cannot be applied to liquid

HAYES SOLOWAY P.C.
130 W. CUSHING ST.
TUCSON, AZ 85701
TEL. 520.882.7623
FAX. 520.882.7643

175 CANAL STREET
MANCHESTER, NH 03101
TEL. 603.668.1400
FAX. 603.668.8567

crystal. Accordingly, it is preferable that the pixel auxiliary electrode is arranged just below the pixel electrode, and the common auxiliary electrode is arranged just below the common electrode.

Please amend the paragraph bridging page 16, line 27-page 17, line 6, as follows:

The in-plane switching mode active matrix type liquid crystal display device may preferably further include[[s]] a reverse-rotation preventing structure in a sub pixel area in which all liquid crystal molecules are rotated in the same direction, for preventing liquid crystal molecules from rotating in a direction opposite to the same direction, wherein at least a part of edges of the pixel auxiliary electrodes and the common electrode lines is formed oblique such that an initial alignment orientation of liquid crystal molecules overlaps a direction of an electric field generated in the sub pixel area in all sub-areas in the sub pixel areas, if the initial alignment orientation rotates by an acute angle.

Please amend the paragraph beginning at page 18, line 3, as follows:

By covering the first and second contact holes at its inner surfaces with a metal film, it would be possible to reduce [[a]] resistance between the common electrode and the common electrode line both composed of a transparent metal, and enhance uniformity in displaying images.

Please amend the paragraph bridging page 18, line 29-page 19, line 4, as follows:

This ensures that it is no longer necessary to form an interlayer insulating film between the common electrode and the data line in an area which is ~~large more~~ larger than necessary, and hence, the data line can be almost entirely covered with the common electrode without an increase in [[a]] parasitic capacity between the common electrode and the data line.

HAYES SOLOWAY P.C.
130 W. CUSHING ST.
TUCSON, AZ 85701
TEL. 520.882.7623
FAX. 520.882.7643

175 CANAL STREET
MANCHESTER, NH 03101
TEL. 603.668.1400
FAX. 603.668.8567

Please amend the paragraph beginning at page 22, line 12, as follows:

These metal films ensure reduction in [[a]] resistance, and enhancement in reliability.

Please amend the paragraph beginning at page 22, line 21, as follows:

By electrically connecting the common electrode to the common electrode line through a contact hole in each of pixels, as mentioned above, it would be possible to reduce [[a]] resistance of the common electrode.

Please amend the paragraph bridging page 24, line 29-page 26, line 7, as follows:

There is further provided an in-plane switching mode active matrix type liquid crystal display device includes (a) a first substrate, (b) a second substrate located opposing the first substrate, and (c) a liquid crystal layer sandwiched between the first and second substrates, wherein the first substrate includes (a 1) a thin film transistor having a gate electrode, a drain electrode and a source electrode, (a2) a pixel electrode each associated to a pixel to be driven, (a3) a common electrode to which a reference voltage is applied, (a4) data lines, (a5) a scanning line, and (a6) common electrode lines~~, the~~. The gate electrode is electrically connected to the scanning line, the drain electrode is electrically connected to the data lines, the source electrode is electrically connected to the pixel electrode, and the common electrode is electrically connected to the common electrode lines~~, the~~. The pixel electrode is in a zigzag form and almost equally spaced away from adjacent ones, and the common electrode is in a zigzag form and almost equally spaced away from adjacent ones~~, two-directional~~. Two-directional electric fields almost parallel with a surface of the first substrate are applied across the pixel electrode and the common electrode~~, the~~. The in-plane switching mode active matrix type liquid crystal display device includes a first sub pixel area to which an electric field having a first direction is applied

HAYES SOLOWAY P.C.
130 W. CUSHING ST.
TUCSON, AZ 85701
TEL. 520.882.7623
FAX. 520.882.7643

175 CANAL STREET
MANCHESTER, NH 03101
TEL. 603.668.1400
FAX. 603.668.8567

and in which molecular axes of liquid crystal in the liquid crystal layer are rotated in a first rotational direction in a plane parallel with a surface of the first substrate, and a second sub pixel area to which an electric field having a second direction is applied and in which the molecular axes are rotated in a second rotational direction which is different from the first rotational direction, in a plane parallel with a surface of the first substrate~~, the~~. The common electrode is composed of transparent material, and is formed on a layer located closer to the liquid crystal layer than the data lines~~, the~~. The common electrode entirely overlaps the data lines with an insulating layer being sandwiched therebetween except an area where the data lines are located in the vicinity of the scanning line~~, the~~. The in-plane switching mode active matrix type liquid crystal display device further includes a light-impermeable layer in an area where the common electrode entirely overlaps the data lines~~, the~~. The light-impermeable layer is formed on the second substrate or on the first substrate such that the light-impermeable layer and the liquid crystal layer are located at the same side with respect to the data lines and that the light-impermeable layer faces the data lines~~, the~~. The light-impermeable layer is comprised of a black matrix layer or multi-layered color layers~~, the~~. The black matrix layer or the multi-layered color layers has a width smaller than a width of the common electrode overlapping the data lines, and the data lines extends in a zigzag along the pixel electrode.

Please amend the paragraph beginning at page 26, line 18, as follows:

It would be possible to maximize an aperture ratio by setting the number of [[bent]] bends equal to one in the data lines, the common electrode and the pixel electrode.

Please amend the paragraph beginning at page 26, line 23, as follows:

HAYES SOLOWAY P.C.
130 W. CUSHING ST.
TUCSON, AZ 85701
TEL. 520.882.7623
FAX. 520.882.7643

175 CANAL STREET
MANCHESTER, NH 03101
TEL. 603.668.1400
FAX. 603.668.8567

By setting the number of [[bent]] bends equal to an odd number, it would be possible to equalize a region where liquid crystal molecules are twisted in a clockwise direction to a region where liquid crystal molecules are twisted in a counter-clockwise direction in both an area and the number, ensuring enhancement in symmetry in a viewing angle.

Please amend the paragraph beginning at page 27, line 4, as follows:

The ~~Smaller~~ smaller the number of [[bent]] bends in the data lines, the common electrode and the pixel electrode is, greater an aperture ratio is. However, bending patterns could be seen, if the number of [[bent]] bends is small. It is preferable that the black matrix layer is formed following the [[bent]] bend of the data lines, the common electrode and the pixel electrode, but it would be more difficult to pattern the black matrix layer, if the data lines, the common electrode and the pixel electrode are bent in a smaller number. In contrast, as the data lines, the common electrode and the pixel electrode are bent in a greater number, a bending pattern looks like a line, and hence, the black matrix could be formed more linear and thinner. However, greater the number of ~~bent is,~~ bends, the smaller an aperture ratio is. Taking these into consideration, the above-mentioned equation (A) provides the optimal number of [[bent]] bends in the data lines, the common electrode and the pixel electrode.

Please amend the paragraph bridging page 31, line 12-page 32, line 22, as follows:

There is still further provided an in-plane switching mode active matrix type liquid crystal display device includes (a) a first substrate, (b) a second substrate located opposing the first substrate, and (c) a liquid crystal layer sandwiched between the first and second substrates, wherein the first substrate includes (a1) a thin film transistor having a gate electrode, a drain electrode and a source electrode, (a2) a pixel electrode each associated to a pixel to be driven,

HAYES SOLOWAY P.C.
130 W. CUSHING ST.
TUCSON, AZ 85701
TEL. 520.882.7623
FAX. 520.882.7643

175 CANAL STREET
MANCHESTER, NH 03101
TEL. 603.668.1400
FAX. 603.668.8567

(a3) a common electrode to which a reference voltage is applied, (a4) data lines, (a5) a scanning line, and (a6) common electrode lines~~, the~~. The gate electrode is electrically connected to the scanning line, the drain electrode is electrically connected to the data lines, the source electrode is electrically connected to the pixel electrode, and the common electrode is electrically connected to the common electrode lines~~, the~~. The pixel electrode is in a zigzag form and almost equally spaced away from adjacent ones~~, the~~. The common electrode is in a zigzag form and almost equally spaced away from adjacent ones~~, two-directional~~. Two-directional electric fields almost parallel with a surface of the first substrate are applied across the pixel electrode and the common electrode~~, the~~. The in-plane switching mode active matrix type liquid crystal display device includes a first sub pixel area to which an electric field having a first direction is applied and in which molecular axes of liquid crystal in the liquid crystal layer are rotated in a first rotational direction in a plane parallel with a surface of the first substrate, and a second sub pixel area to which an electric field having a second direction is applied and in which the molecular axes are rotated in a second rotational direction which is different from the first rotational direction, in a plane parallel with a surface of the first substrate~~, an~~. An opening of the first substrate extends in a direction perpendicular to a direction in which the data lines extend~~, the~~. The common electrode is composed of transparent material, and is formed on a layer located closer to the liquid crystal layer than the data lines~~, the~~. The common electrode entirely overlaps the data lines with an insulating layer being sandwiched therebetween except an area where the data lines are located in the vicinity of the scanning line~~, the~~. The common electrode is electrically connected to the common electrode lines through a contact hole in each of pixels~~, the~~. The in-plane switching mode active matrix type liquid crystal display device further

HAYES SOLOWAY P.C.
130 W. CUSHING ST.
TUCSON, AZ 85701
TEL. 520.882.7623
FAX. 520.882.7643

175 CANAL STREET
MANCHESTER, NH 03101
TEL. 603.668.1400
FAX. 603.668.8567

includes a light-impermeable layer in an area where the common electrode entirely overlaps the data lines~~, the~~. The light-impermeable layer is formed on the second substrate or on the first substrate such that the light-impermeable layer and the liquid crystal layer are located at the same side with respect to the data lines and that the light-impermeable layer faces the data lines~~, the~~. The light-impermeable layer is comprised of a black matrix layer or multi-layered color layers~~, the~~. The black matrix layer or the multi-layered color layers has a width smaller than a width of the common electrode overlapping the data lines~~, the~~. The data lines extend in a line~~, a~~. A gate line which constitutes the gate electrode extends in a zigzag.

Please amend the paragraph bridging page 33, line 5-page 34, line 5, as follows:

There is yet further provided an in-plane switching mode active matrix type liquid crystal display device including (a) a first substrate, (b) a second substrate located opposing the first substrate, and (c) a liquid crystal layer sandwiched between the first and second substrates, wherein the first substrate includes (a1) a thin film transistor having a gate electrode, a drain electrode and a source electrode, (a2) a pixel electrode each associated to a pixel to be driven, (a3) a common electrode to which a reference voltage is applied, (a4) data lines, (a5) a scanning line, and (a6) common electrode lines~~, the~~. The gate electrode is electrically connected to the scanning line, the drain electrode is electrically connected to the data lines, the source electrode is electrically connected to the pixel electrode, and the common electrode is electrically connected to the common electrode lines~~, the~~. The pixel electrode is in a zigzag form and almost equally spaced away from adjacent ones~~, the~~. The common electrode is in a zigzag form and almost equally spaced away from adjacent ones~~, two-directional~~. Two-directional electric fields almost parallel with a surface of the first substrate is applied across the pixel electrode and the

HAYES SOLOWAY P.C.
130 W. CUSHING ST.
TUCSON, AZ 85701
TEL. 520.882.7623
FAX. 520.882.7643

175 CANAL STREET
MANCHESTER, NH 03101
TEL. 603.668.1400
FAX. 603.668.8567

common electrode~~, the~~. The in-plane switching mode active matrix type liquid crystal display device includes a first sub pixel area to which an electric field having a first direction is applied and in which molecular axes of liquid crystal in the liquid crystal layer are rotated in a first rotational direction in a plane parallel with a surface of the first substrate, and a second sub pixel area to which an electric field having a second direction is applied and in which the molecular axes are rotated in a second rotational direction which is different from the first rotational direction, in a plane parallel with a surface of the first substrate~~, an~~. An isolated floating electrode formed of a layer of which the gate electrode or the drain electrode is formed overlaps the common electrode or the pixel electrode at bending portions of the zigzag-shaped common or pixel electrode with an insulating film being sandwiched therebetween~~, at~~. At least one of the common and pixel electrodes have a projection projecting from bending portions of the zigzag-shaped common and pixel electrodes in a direction in which the bending portions project, along a boundary between the first and second sub pixel areas.

Please amend the paragraph bridging page 34, line 16-page 35, line 12, as follows:

In still another aspect of the present invention, there is provided a method of fabricating an in-plane switching mode active matrix type liquid crystal display device including (a) a first substrate, (b) a second substrate located opposing the first substrate, and (c) a liquid crystal layer sandwiched between the first and second substrates, wherein the first substrate includes (a1) a thin film transistor having a gate electrode, a drain electrode and a source electrode, (a2) a pixel electrode each associated to a pixel to be driven, (a3) a common electrode to which a reference voltage is applied, (a4) data lines, (a5) a scanning line, (a6) common electrode lines, (a7) a data line terminal, (a8) a scanning line terminal, and (a9) a common electrode line terminal~~, the~~. The

HAYES SOLOWAY P.C.
130 W. CUSHING ST.
TUCSON, AZ 85701
TEL. 520.882.7623
FAX. 520.882.7643

175 CANAL STREET
MANCHESTER, NH 03101
TEL. 603.668.1400
FAX. 603.668.8567

gate electrode is electrically connected to the scanning line, the drain electrode is electrically connected to the data lines, the source electrode is electrically connected to the pixel electrode, and the common electrode is electrically connected to the common electrode lines, and molecular axes of liquid crystal in the liquid crystal layer are rotated in a plane parallel with the first substrate by an electric field substantially parallel with a plane of the first substrate and to be applied between the pixel electrode and the common electrode, to thereby display certain images~~, the~~. The method includes the steps of (a) forming the thin film transistor, the data lines, the scanning line and the common electrode line, and thereafter, forming an interlayer insulating film thereover, (b) etching the interlayer insulating film to form contact holes reaching the data lines, the scanning line and the common electrode line, (c) deposit transparent metal all over a product resulted from the step (b) to cover inner surfaces of the contact holes with the transparent metal, thereby forming the data line terminal, the scanning line terminal and the common electrode line terminal, and (d) etching the transparent metal to form the common electrode such that the common electrode overlaps the data lines.

Please amend the paragraph bridging page 35, line 24-page 36, line 27, as follows:

There is further provided a method of fabricating an in-plane switching mode active matrix type liquid crystal display device including (a) a first substrate, (b) a second substrate located opposing the first substrate, and (c) a liquid crystal layer sandwiched between the first and second substrates, wherein the first substrate includes (a1) a thin film transistor having a gate electrode, a drain electrode and a source electrode, (a2) a pixel electrode each associated to a pixel to be driven, (a3) a common electrode to which a reference voltage is applied, (a4) data lines, (a5) a scanning line, and (a6) common electrode lines~~, the~~. The gate electrode is

HAYES SOLOWAY P.C.
130 W. CUSHING ST.
TUCSON, AZ 85701
TEL. 520.882.7623
FAX. 520.882.7643

175 CANAL STREET
MANCHESTER, NH 03101
TEL. 603.668.1400
FAX. 603.668.8567

electrically connected to the scanning line, the drain electrode is electrically connected to the data lines, the source electrode is electrically connected to the pixel electrode, and the common electrode is electrically connected to the common electrode lines~~, the~~. The pixel electrode is in a zigzag form and almost equally spaced away from adjacent ones~~, the~~. The common electrode is in a zigzag form and almost equally spaced away from adjacent ones~~, two-directional~~. Two-directional electric fields almost parallel with a surface of the first substrate are applied across the pixel electrode and the common electrode~~, the~~. The in-plane switching mode active matrix type liquid crystal display device includes a first sub pixel area to which an electric field having a first direction is applied and in which molecular axes of liquid crystal in the liquid crystal layer are rotated in a first rotational direction in a plane parallel with a surface of the first substrate, and a second sub pixel area to which an electric field having a second direction is applied and in which the molecular axes are rotated in a second rotational direction which is different from the first rotational direction, in a plane parallel with a surface of the first substrate~~, the~~. The method includes the steps of (a) forming the thin film transistor, the data lines, the scanning line and the common electrode line, and thereafter, forming an interlayer insulating film thereover, (b) etching the interlayer insulating film to form contact holes reaching the data lines, the scanning line and the common electrode line, (c) deposit transparent metal all over a product resulted from the step (b) to cover inner surfaces of the contact holes with the transparent metal, thereby forming the data line terminal, the scanning line terminal and the common electrode line terminal, and (d) etching the transparent metal to form the common electrode such that the common electrode overlaps the data lines.

Please amend the paragraph beginning on page 37, line 13, as follows:

HAYES SOLOWAY P.C.
130 W. CUSHING ST.
TUCSON, AZ 85701
TEL. 520.882.7623
FAX. 520.882.7643

175 CANAL STREET
MANCHESTER, NH 03101
TEL. 603.668.1400
FAX. 603.668.8567

(d) to provide an in-plane switching mode liquid crystal display device in which transparent electrodes can be fabricated with low cost[[s]];

Please amend the paragraph beginning on page 46, line 12, as follows:

In the specification, an "upper" layer means a layer located closer to the liquid crystal layer 13, and a "lower" layer means a layer located more remote ~~remoter~~ from the liquid crystal layer 13 in both the active device substrate 11 and the opposing substrate 12.

Please amend the paragraph beginning on page 80, line 8, as follows:

Since the pixel electrode 27 is comprised of the second metal layer 27, the liquid crystal display device 80 has a smaller aperture ratio than that of the liquid crystal display device 10. However, since the pixel electrode 27 is comprised of a layer different from a layer of which the common electrode 26 is formed, in the second embodiment, the pixel electrode 27 and the common electrode 26 would not be short-circuited to each other, ensuring enhancement in a fabrication yield.

Please amend the paragraph beginning on page 81, line 6, as follows:

Since the common electrode 26 is comprised of the first metal layer in an area other than an area in which the common electrode 26 is composed of a transparent metal film formed on the second film 25b, the in-plane switching mode liquid crystal display device 85 in accordance with the third embodiment has a smaller aperture ratio than that of the liquid crystal display device 10 in accordance with the first embodiment. However, since the common electrode 26 is comprised of a layer different from a layer of which the pixel electrode 27 is formed, the common electrode 26 and the pixel electrode 27 would not be short-circuited to each other, ensuring enhancement in a fabrication yield.

HAYES SOLOWAY P.C.
130 W. CUSHING ST.
TUCSON, AZ 85701
TEL. 520.882.7623
FAX. 520.882.7643

175 CANAL STREET
MANCHESTER, NH 03101
TEL. 603.668.1400
FAX. 603.668.8567